

We claim:

1. An apparatus for online elemental analysis of a sample comprising
an online sampling means for receiving a sample,
at least one X- ray source, and
at least one X- ray fluorescence detector for detecting X- ray fluorescence from said
sample and for producing signals in response to said X- ray fluorescence,
wherein said at least one X- ray source and said at least one X- ray fluorescence detector are
mounted in a geometry that maximizes X- ray detection and sensitivity.
2. The apparatus of claim 1 wherein said at least one X- ray fluorescence detector is mounted
within 2 inches of said sample.
3. The apparatus of claim 1 wherein said at least one X- ray source is characterized by a
transmission axis and wherein said at least one X- ray fluorescence detector is characterized by a
detection axis, and wherein said transmission axis and said detection axis are aligned to within
30 degrees of the sample surface normal.
4. The apparatus of claim 3 wherein said X- ray transmission axis and said detection axis are
parallel to each other and normal to the sample surface.
5. The apparatus of claim 1 wherein said at least one X- ray source and said at least one X- ray
fluorescence detector are disposed in a backscattering geometry.

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A7 6. The apparatus of claim 1 further comprising a thin window (0.002-0.010 inches) disposed between the sample and the X-ray detector.

5 7. The apparatus of claim 6 wherein said thin window is comprised of a polymeric core coated with a resin or acrylic.

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A8 8. The apparatus of claim 1 wherein further comprising a shaping device for maintaining a uniform sample surface.

10 9. The apparatus of claim 8 wherein said shaping device comprises a plow or a flow cell.

15 10. The apparatus of claim 8 further comprising a means for controlling said sampling means to provide a uniform sample profile.

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A9 11. The apparatus of claim 1 further comprising a means for detecting the presence of sufficient sample material.

20 12. The apparatus of claim 11 wherein said means for detecting the presence of sufficient sample material comprises a microwave, X-ray or γ -ray sensor oriented in a transmission geometry.

9 10 13. The apparatus of claim 1 further comprising including a microwave moisture reader.

14. The apparatus of claim 1 further comprising a belt scale or density gauge.

15. The apparatus of claim 1 further comprising a flowmeter assembly.

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